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COOPERATIVE MEMBERSHIP AND MULTIDIMENSIONAL POVERTY AMONG POULTRY FARMING HOUSEHOLDS IN SOUTHWEST NIGERIA, EVIDENCE FROM OYO STATE: AN ALKIRE-FOSTER ANALYSIS AND IMPACT MEASUREMENT APPROACH

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ABSTRACT

This study was conducted in Southwest Nigeria to examine the impact of cooperative membership on the poverty status of poultry farming households in Southwest Nigeria, using the multidimensional approach while controlling for selection bias. This can enhance understanding for more impactful policy making. A multistage sampling technique was employed in the random data collection from 210 poultry farmers; 101 Cooperators and 109 Noncooperators from four local government areas, using well-structured questionnaires. Descriptive statistics, Alkire-Foster multidimensional poverty indices, Treatment effect models of the propensity score matching, inverse probability weighing and nearest neighbour matching algorithms are employed in data analysis. The multidimensional poverty index, incidence of deprivation across nine of the various ten welfare indicators with the aggregated average intensity of deprivations was found to be significantly higher among the Noncooperator poultry farming household category when compared to their Noncooperator counterparts. Also, Cooperative societies apart from its poverty reduction impact on the Cooperator, was also found to have significant negative impact on multidimensional poverty status among Noncooperator poultry farming households. Multipurpose cooperatives was found to reduce poverty more than other types of cooperatives. Finding based policy options were proffered

Keyword: Cooperative membership, Multidimensional poverty, Nigeria, Alkire-Foster multidimensional poverty measures, Welfare, Treatment effects.

1. INTRODUCTION

Poverty has been a global issue of many dimensions and complexities, a longstanding quagmire among the estimated world's 6.9 billion people with varying rate of occurrence from one part of the world to another. Although, world's extreme poverty of below US$2.0/person per day has reduced significantly from 18.6% (2008) to 14.5% (2011) and 11.0% (2013), indicating a shrinking global poverty trend however, high incidence of poverty is widespread in the Sub-Saharan Africa and South Asia relative to other developing regions, accounting for about 80% of the global poor of which about 50.7% of the global poor lives in sub-Saharan Africa, especially in Nigeria (World

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Bank 2015;2016) where Agriculture has been the locus of poverty and about 70% of the population are directly or indirectly dependent on agriculture for their livelihood (NBS 2012;2014). Also, the welfare of farmers remains generally low due to fall in productivity, attributable to menace of low agricultural technology, food insecurity and low income (Amao and Awoyemi, 2008). The livestock sector can however serve as a significant source of livelihoods, and a potential pathway out of poverty (IFAD, 2011), wherein the largest share of the poor among the 900 million peopleresides in rural areas, and half of these poor rear livestock (World Bank, 2016; Robinson, 2011).

It is notable that, of the total GDP accrued to the Agricultural industry within the Nigeria's economy, the various sub-sector contributions includes; Crop (87.2%), Livestock (9.0%), Fishery (3.0%) and Forestry (1.2%) respectively, where the livestock sector contributes relatively low (FAO 2016, NBS 2015). The Nigerian poultry industry is characterized by small-holder farmers rearing below 1000 birds (Ministry of Agriculture, 2012), employing different production strategies with little available resources resulting to low productivity, production inefficiency and low return to investment hence, poverty.

In an attempt to tackle the challenges facing the sector, willing farmers usually come together, forming a member focused institution where they pool resources together via a jointly owned and democratically controlled enterprise, usually called Cooperative society. Cooperatives serves an important means of poverty reduction, they identify economic opportunities for their members; empower the disadvantaged; secure the poor by converting their individual risks into joint risks; and mediate members' access to assets to earn good living as Cooperatives focuses on its members rather than profit making. There is a widely held consensus among many economic key role actors, including the United Nations (UN), the International Labour Organization (ILO), and the International Co-operative Alliance (ICA) that, the cooperative enterprise is typically suited to addressing all dimensions of reducing poverty and exclusion (ILO; ICA, 2015).

Teklehaimanot et al., (2016) assessed the impact of agricultural marketing cooperative societies in enhancing rural livelihood in India, using the livelihood assets approach, a non-monetary approach. Their results showed a declining poverty and increasing income as a result of the marketing society in which a significant change was found in habitat, social, income and food security among marketing society members. Tolulope et al. (2016) evaluated the poverty situation mong 172 farming households in selected areas in Ibadan, Oyo state. The incidence of poverty was 50.58% and the average intensity of poverty was 48.7%, the Multidimensional Poverty Index (MPI) for the sampled households was 0.246. Besides, Oyekale et al., (2006) evaluates the impact of poverty reduction programs on multidimensional poverty in rural Nigeria, using the 2006 core welfare indicator survey (CWIQ) data and Fuzzy set approach. The result shows that the multidimensional poverty for the rural Nigeria is 0.3796.

However, many of the previous researches on multidimensional poverty did not explore the specific dimensions of deprivation suffered by the poor households, did not control for selection bias where necessary, restricted to estimating income poverty while a little empirical researches relates poultry production and cooperative membership to multidimensional poverty in the study area. This is probably due to scarce methods to link poultry production and cooperative membership to multidimensional poverty. Besides, most impact studies do not capture the potential differences between participants/cooperators and nonparticipants/noncooperators, making it difficult to conclude on the estimation (Rahman 1999; Mendola 2007). Also, little is

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however known about the extent to which cooperative societies have achieved this primary goal among its members in the study area, where there is widespread Poultry production activities as Oyo State has the highest incidence of registered poultry farmers in Nigeria (PAN, FDLPCS, 2007).

Furthermore, the deprivations experienced by the farmers are more than just income poverty. Poverty is a multi-dimensional phenomenon for which causes, conditions, and consequences remain difficult to directly identify, and quantify hence, requires a cross dimensional approach in its measurement. This study thus attempts to evaluate the impact of Cooperative membership on the poverty status of poultry farmers in Oyo state. Specifically, the multidimensional poverty status of poultry farmers was estimated and profiled across cooperatives. The impact of cooperative membership on the multidimensional poverty status of poultry farming households was also assessed.

2. MATERIALS AND METHODS

Study area/ Data Collection

This study was carried out in Oyo State, South western Nigeria. The state's land area covers 35,743 km2 situated within latitude 3 and 5°N; between longitude 7°E and 9.3°E, characterized by intensive rearing of exotic breeds of cockerels, layers and broiler birds which is a widespread activities in the study areas. Four (4) Agricultural Development Project (ADP) zones exist in the state as categorized by the Oyo state Agricultural Development Project (OYSADEP) which includes; Ibadan/Ibarapa, Oyo, Ogbomoso and Saki zones, with varying degrees of poultry production activities.

Data related to the socio-economic characteristics alongside farm Production activities of the poultry farmers among others was collected, in addition to data on education, living standard and health of farmers were collected from the poultry farmers in the study area, using a multistage sampling technique.

The first stage involved random selection of two agricultural zones which are Ibadan/Ibarapa and Oyo Agricultural zones from the four Agricultural Zones in Oyo state. The second stage involved a random selection of three local government areas under the Oyo agricultural zone and one Local government in Ibadan/Ibarapa Zone due to the relatively larger poultry production activities being carried out at Oyo agricultural zone compared to Ibadan/Ibarapa. The third stage involved a random selection of ten villages under Ido Local government area and three villages per Afijio, Oyo central, and Oyo west local government areas, from which 240 poultry farmers were randomly selected in the final stage. Data collection was between June-August, 2017 with the supports of three volunteer field enumerators. Only 210 samples were utilized in the analysis due to nonresponse and non-return of questionnaires.

The Statistics and Data (STATA) '14 analytical tool was used in data analysis.

Analytical techniques

a. Alkire and Foster Measure (AFM) for estimating multidimensional poverty

The Alkire Foster multidimensional measures distinguishes 'the poor and nonpoor' by considering the range of deprivations they suffer. The methodology includes two steps: considering the range of deprivations they suffer, and an aggregation to generates an intuitive set of poverty measures ($M\alpha$) that can be broken down to target the poor people and the dimensions in which they are most

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deprived.

Dimensions, indicators, cutoffs, and weights

A vector w = (w1,…,wd) of weights or deprivation values is used to indicate the relative importance of the different deprivations and all weights sum up to the number of dimensions "d". The vector "C" of deprivation counts is compared against a cut-off "k" to identify the poor. The variable k reflects the sum of weighted indicators in which a household must be deprived in order to be considered multidimensionally poor. "k" is inversely proportional to incidence of poverty (H¬¬¬0) while the intensity or breadth of deprivations (A0) in any poor household increases. We report three levels for k; k=4, k= 3 and k= 2 for comparison.

When k = 3, a household has to be deprived in at least the equivalence of 30% of the weighted indicators in order to be considered multidimensionally poor, implying that if Cis 33.3% or greater, that household is multidimensionally poor. This is decomposable into six asset indicators, or two health, or education indicators. If we choose instead cutoff value k = 2 then all poor households must be deprived in at least 20% of the indicators (chronic poverty). The maximum score is 100%; with each dimension equally weighted (thus the maximum score in each dimension is 33.3%). Each indicator within a dimension is also equally weighted. A poverty cut-off k satisfying $0 < k \leq C$ is used to determine whether a farmer has sufficient deprivations to be considered poor or otherwise. Specifically, the deprivation headcount (Ho) and the dimension adjusted head count (Mo) model following Alkire and Foster, (2011), are given as;

$$H_o\,(X; k; Z) \equiv \frac{1}{N}\sum_{n=1}^{N} I\,(Cn \geq k) = \frac{q}{N} \quad \ldots\ldots(1)$$

$$A\,(X; k; Z) \equiv \frac{\sum_{n=1}^{N} I\,(Cn \geq k) Cn}{q} = \frac{\sum_{1}^{q} c}{q} \quad \ldots\ldots(2)$$

$$M_o \equiv \left[\frac{1}{N}\sum_{n=1}^{N} I\,(Cn \geq k)\right]\left[\frac{\sum_{1}^{q} c}{q}\right] = H_o \times A \quad \ldots\ldots(3)$$

Where:

Ho= Head Count Ratio, A = Average intensity of deprivation, M0 = Multidimensional Poverty Index (MPI), q = the number of people who are multidimensionally poor, N= Total population, C= is the deprivation score that the poor experience, I (Cn ≥ k) = indicator that takes the value of 1 if the expression in parenthesis is true. Otherwise it takes the value of 0. Indicators and dimensions chosen were based to a large extent on international standards such as the Sustainable Development Goals. The indicators and cutoffs are summarized in table 1.

Table 1: Dimensions, indicators and weights

Dimensions	Indicators	Measurements	Related to…	Weights
Education	Years of schooling	Deprived if no household member has completed 9 years of formal education	SDG 4	1/6
	Child enrolment	Deprived if any school-aged child is not attending school in years 1 to 6	SDG 4	1/6
Standard of Living	Electricity	Deprived if the household has no electricity	SDG 7	1/18

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	Drinking water	Deprived if the household does not have access to clean drinking water or clean water is more than 30 minutes' walk from home	SDG 6	1/18
	Sanitation	Deprived if they do not have an improved toilet or if their toilet is shared	SDG 6	1/18
	Housing	Deprived if hut/house/ has a dirt, sand or dung floor or is built with sub-standard material	SDG 11	1/18
	Cooking fuel	Deprived if they cook with wood, charcoal or dung	SDG 7	1/18
	Assets	Deprived if the household does not own more than one of: radio, TV, telephone, bike, or motorbike, and do not own a car or tractor	SDG 12	1/18
Health	Health care quality	Deprived if the household does not have access to quality health care	SDG 3	1/6
	Health as a Limiting factor	Deprived if health is a limiting factor in most regular activities	SDG 3	1/6

Note: SDG1 is Eradicate Extreme Poverty; SDG2 is Zero Hunger; SDG3 is Good Health and Well-being; SDG4 is Quality Education; SDG6 is Clean Water and Sanitation SDG7 is Affordable and clean Energy; SDG11 is Sustainable cities and Communities; SDG12 is Responsible consumption and Production.

Source: (UNDP, 2015; Alkire et al. 2016).

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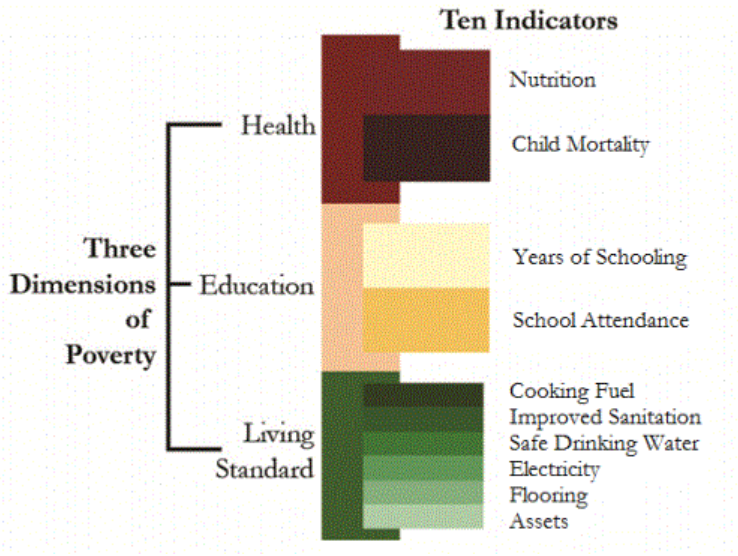

Figure 1: Dimensions and indicators of multidimensional poverty
Source: Alkire et al., (2016).

b. Impact measurement and selection biases control.

It is worth nothing that a good impact measurement design requires appropriate counterfactual, while controlling for selection bias (Imbens, and Wooldridge, 2009; Dontsop et al., (2011). The nearest neighbour matching, Inverse probability weighing and the propensity score matching methods are employed in the evaluation of impact of cooperative membership on the multidimensional poverty status of poultry farmers.

Propensity score matching (PSM) method.

This study employs the non-parametric approach. First, the model estimate the propensity score (PS) as the probability of the sampled farmers to be a member of an agricultural cooperative (D).
PS= P(D=1|X)……(4).

We use a Probit model and include a large set of conditioning factors (Xi) that can explain a possible non-random distribution of cooperative membership in the population:

Where; X1 = Gender of household head (dummy; Male=1, Female=0), X2 = Marital status (dummy; 1, if married 0, if otherwise), X3 = Level of education of Household head (years), X4 = Highest level of education in the household other than household head's (years), X5= Age of Household Head in years, X6 = Household size, X7= Dependency ratio, X8= Farming experience level (in years), X9= Farming as Primary occupation (dummy yes=1, otherwise=0), X10= Access to credit (dummy; Yes= 1; No=0), X11= Access to infrastructure (dummy; Yes= 1; No=0), X12= Primary source of labour (Dummy; Paid labor=1, Family Labor=0), X13= Cooperative membership (dummy; Yes=1; No=0).

Average treatment effects (ATE) of cooperative membership on multidimensional poverty is estimated. We use the estimated PS to match treated observations or cooperative member households with untreated observations or non-member households. The average treatment effects is estimated as the average difference in the poverty (deprivations) between treated Y(1), and

matched controls Y(0) as used by Imbens, 2004; Rosenbaum and Rubin, 1983.

ATE= E[Y(1)−Y(0)]=E[Y(1)]−E[Y(0)]………………………………......….......….(5)

ATET = E [Y (1) − (Y (0) |W=1] ………………………….……………......……..(6)

$$\mathrm{ATE} = n^{-1} \sum_{i=1}^{n} \frac{D_i - P(X_i))Y_i}{P(X_i)(1-P(X_i))} \quad \ldots(7)$$

$$\mathrm{ATE1} = n^{-1} \sum_{i=1}^{n} \frac{D_i - P(X_i))Y_i}{(1-P(X_i))} \quad \ldots(8)$$

n = sample size,

$\sum_{i=1}^{n} D_i$ = Number of treated,

$P(X_i)$ = consistent estimate of the propensity score evaluated.

Nearest neighbour matching

Nearest neighbour matching requires a selection and matching each treatment and control units with the closest propensity scores; i.e., the Nearest Neighbour. It generally selects k matched controls for each treated unit (often, k=1) Rubin, (1973). The nearest neighbour matching uses a "greedy" algorithm, which cycles through each treated unit one at a time, selecting the available control unit with the smallest distance to the treated unit.

$$\| x \| V = (x' V_{x})^{\frac{1}{2}} \quad \ldots (9)$$

$$\| z - x \| V \quad \ldots (10)$$

Considering the set of observed covariates for an individual i, Xi, let eqn. 9 be the normal vector, having positive definite matrix V. We define eqn. 10 as the distance between the vectors x and z, where z represents the covariate values for a potential match for observation i. Let dM(i) be the distance from the covariates for unit i, Xi, to the Mth nearest match with the opposite treatment. Allowing for the possibility of ties, at this distance fewer than M units are closer to unit i than dM(i) and at least M units are as close as dM(i). Formally, dM(i) >0 is the real number satisfying; x′ Vx (Alberto *et al.*, 2004)

$$\sum_{l:W_l=1-W_i} 1\left\{\|X_l - X_i\|_V < d_M(i)\right\} < M \quad \ldots (11)$$

and

$$\sum_{l:W_l=1-W_i} 1\left\{\|X_l - X_i\|_V \le d_M(i)\right\} \ge M \quad \ldots (12)$$

Where: 1{•} is the indicator function, which is equal to one if the expression in brackets is true and zero if otherwise.

Let JM(i) denote the set of indices for the matches for unit i that are at least as close as the Mth match:

$$\mathcal{J}_M(i) = \left\{ l = 1, \ldots, N \middle| W_l = 1 - W_i, \|X_l - X_i\|_V \le d_M(i) \right\} \quad \ldots (13)$$

These estimates can be utilized to estimate the average treatment effect for the treated (ATET) as follows;

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$$T_M^{sm,t} = \frac{1}{N}\sum_{t:W_i=1}\left\{Y_i - \hat{Y}(0)\right\} = \frac{1}{N}\sum_{t=1}^{N}\{W_i - (1-W_i)K_M(i)\}Y_i \quad \text{.....(14)}$$

or the average treatment effect (ATE) for the controls

$$T_M^{sm,c} = \frac{1}{N_0}\sum_{t:W_i=1}\left\{\hat{Y}(1) - Y_i\right\} = \frac{1}{N_0}\sum_{t=1}^{N}\{W_i K_M(i) - (1-W_i)\}Y_i \quad \text{.....(15)}$$

Inverse probability weighting

Inverse probability weighting (IPW) estimates the effects, by using means of the observed outcomes weighted by the inverse probability of treatment. The IPW estimators use quasi-maximum likelihood (QML) to estimate the parameters of the conditional probability model. The vector of estimating functions is the concatenation of the estimating functions for the effect parameters with the estimating functions for the conditional probability parameters (Cattaneo *et al*., 2013). The sample estimating functions used by the IPW estimators are;

$$S_{ipw,i}(x_i, \hat{\theta})' = s_{ipw,e,i}(x_i, \hat{\theta}, \hat{Y})' s_{tm,i}(z_i, 1, \hat{Y})' \quad \text{.....(16)}$$

The estimating functions Sipw, (xi, θ, γ)´ vary over the effect parameter.

3. RESULTS AND DISCUSSION

a. Distribution of cooperative membership status among Poultry farmers

Table 2 shows the distribution of cooperative membership status among the Cooperator poultry farmers in the study area. The result shows that most of the Cooperators (59 %) belongs to the multipurpose cooperative society, while about 7% belongs to producer and marketing cooperative societies. The observed relatively higher membership incidence of multipurpose cooperative society can be linked to the multipurpose/ multifaceted benefits it offers its members.

Table 2: Distribution of Cooperators poultry farmers by cooperative type

Cooperative membership status	Frequency	Percentage
Producer Cooperators	7	6.93
Marketing Cooperators	7	6.93
Consumer Cooperators	27	26.73
Multipurpose Cooperators	60	59.41
Total Cooperators	**101**	**48.09**
Total Noncooperators	**109**	**51.90**
Pooled	**210**	**100.00**

Source: Author's field survey data analysis result, 2017

b. Description of demographic and socioeconomic characteristics

The summary of the demographic and socioeconomic characteristics of the Cooperator and noncooperator poultry farmers is shown in table 3. The result shows that, about 74% and 77% of the Cooperator and Noncooperator poultry farmers are respectively married while the mean age of the Cooperator and noncooperator poultry farmers is 47 years. The modal age group was 41-50 years for both categories of poultry farmers indicating that most of the poultry farmers are within the productive age. This is in consonance with the findings of Adeoti (2014), and Adenuga et al.,

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(2016). There exist a significant difference (at p<0.005) in the mean age of Cooperator and noncooperator poultry farmers. The mean years of farming experience was 11years, while the mean household size is 5 persons per poultry farming households. Regarding access to infrastructure, more than 81% of the poultry farmers in the study area are deprived of access to electricity on their poultry farm while only about 18% does. Also, more than 76% of the poultry farmers in the study area do not have access to extension services while only about 24% have access to extension services. This is most likely due to shortage of extension agents in the study area.

Table 3: Description of Socioeconomic Characteristics of Poultry Farmers by Cooperative membership status

Characteristics	Cooperators N=101	%Non-Cooperators N=109	%Pooled N=210
Gender			
Male	88 (87.05)	92 (84.40)	180 (85.71)
Female	13 (12.87)	17 (15.60)	30 (14.29)
Marital status			
Married	75 (74.26)	84 (77.06)	159 (75.71)
Single	26 (25.74)	25 (22.94)	51 (24.29)
Mean Age	49.14 (1.16)	44.67 (1.18)	46.82 (0.84) P= 0.0036***
Mean years of formal education	18.27 (0.39)	17.45 (0.57)	17.45 (0.36) P=0.47
Mean Years of Farming Experience	12.14 (1.17)	10.17 (1.13)	11.08 (0.39) P=0.3009
Mean Household Size	4.69 (0.22)	4.28 (0.21)	4.49 (0.33) P= 0.2216
Access to Infrastructure			
Yes	23 (22.77)	15 (13.76)	38 (18.10)
No	77 (77.23)	94 (86.24)	172 (81.90)
Access to extension agent			
Yes	30 (29.70)	20 (18.35)	50 (23.81)
No	71 (70.30)	89 (81.65)	160 (76.19)
Labour Source			
Family	27 (26.73)	36 (33.03)	63 (30.00)
Paid	43 (42.57)	59 (54.13)	102 (48.57)
Both	31 (30.69)	14 (12.84)	45 (21.43)

Source: Author's field survey data analysis result, 2017. Robust standard deviation Parenthesized. Level of Sig ***P ≤0.01, **P ≤0.05, *P ≤0.10

c. Multidimensional poverty status

Incidence of deprivation

Table 4 shows the cross tabulated incidence of deprivation among the Cooperator and Noncooperator poultry farmers in the study area. From the result, the highest incidence of

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deprivation occurs in the standard of living dimension manifesting in form of poor access to potable water as about 54% of the poultry farmers are deprived of access to clean water, where 56% and 53% are Cooperator and Noncooperator respectively. Also, about 36% are deprived in asset acquisition where 42%and 30% are Noncooperator and Cooperator respectively. Furthermore, about 26% of the poultry farmers in the study area lack access to quality healthcare. Regarding Child's school enrolment, only 9% of the poultry farming households are deprived. This low incidence of deprivation in the education dimension could indicate the success of the Universal Basic Education (UBE) programme of the government as part of the effort to achieve the sustainable development goal through free and compulsory basic education programme.

Table 4: Cross tabulation of the incidence of Deprivation across indicators by cooperative membership status.

Dimensions and Indicators	Cooperators N=101		Non-Cooperators N=110		Pooled N=210	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
Education						
Basic enrolment	4	3.96	10	9.17	14	6.67
Child Enrollment	6	5.94	14	12.84	20	9.52
Health						
Quality Health Care	23	22.77	32	29.36	55	26.19
Sickness	16	15.84	8	7.34	24	11.43
Standard of Living						
Electricity	18	17.82	33	30.28	51	24.29
Clean Water	57	56.44	58	53.21	115	54.76
Sanitation	19	18.81	25	22.94	44	20.95
Housing	5	4.95	17	15.60	22	10.48
Cooking fuel	14	13.86	33	30.28	47	22.38
Asset	30	29.70	46	42.0	76	36.19

Source: Field Survey data analysis result, 2017.

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d. Multidimensional poverty status across cutoffs (k=2, k=2, k=3)

The estimates of the respondents' poverty index at each level of deprivation cut-offs; "K=2, K=3, K=4" are shown on Table 5. The results reveal that when the poverty line is set at "k=2"; about 35% of the poultry farming households are chronically poor of which 39% and 31% are respectively Noncooperator and Cooperator, respectively suffering from 39.1% and 32.9% of the averagely weighted indicators while at "k=3", about 20% are multidimensionally poor of which 22.0% are Noncooperators and 17%% are Cooperators, respectively suffering from 50.7% and 38.9% averagely weighted indicators.

Table 5 also shows that the deprivation status of the Noncooperator poultry farmers is higher than that of their Cooperators counterpart at each level of K. The pooled MPI of the poultry farmers are 0.126, 0.091, and 0.062 at K=20%, K=30% and K=40% respectively. Also, the relationship of poverty incidence (H0), and average intensity of deprivation (A) with "k" is inverse and direct respectively such that; the higher the level of "k", the lower the poverty incidence and the higher the average intensity of deprivation and vice versa such that deprivation incidence when K=20%> K=30% > K=40% and the average intensity of deprivation when K=2< K=3< K=4. This is in consonance with the results of Adeoti and Adeoti (2014) and Adenuga et al. (2015).

Table 5: Multidimensional poverty status at 20%, 30%, and 40% deprivation cut-offs

Parameters	Cooperators N=101	Noncooperators N=109	Pooled N=210
When K=4			
Multidimensional Headcount (H_0)	0.069	0.156	0.114
Intensity of Deprivation (A)	0.484	0.571	0.546
Multidimensional Poverty Index (M_0)	0.033	0.089	0.062
When K=3			
Multidimensional Headcount (H_0)	0.168	0.220	0.195
Intensity of Deprivation (A)	0.389	0.507	0.466
Multidimensional Poverty Index (M_0)	0.065	0.112	0.091
When K=2			
Multidimensional Headcount (H_0)	0.307	0.385	0.348
Intensity of Deprivation (A)	0.329	0.391	0.365
Multidimensional Poverty Index (M_0)	0.101	0.151	0.126

Source: Field Survey data analysis result, 2017.

e. Multidimensional poverty status across cooperative societies

Table 6 shows the multidimensional poverty status across the cooperative societies. The result shows that, about 29%, 19%, 15%, and 14% respectively of the producers, consumers, multipurpose and marketing Cooperator poultry farmers are living below the poverty line while

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respectively deprived in 58%, 41%, 40%, and 33% of the averagely weighted indicator, 19% of the Consumer Cooperator poultry farmers fell below the poverty line and are deprived in 41% of the averagely weighted indicators. The comparatively low incidence of deprivation observed among the marketing cooperative poultry farmers is linkable to the relatively higher market access/advantage that they are able to harness via their cooperative society hence, bringing about increased sales, which transcends to increased revenue and consequently lower poverty while the highest poverty incidence is observed amidst the producer Cooperators.

Table 6: Multidimensional poverty status of the poultry farmers across the cooperative types at K=30%

Parameters	**Cooperators**					**Noncooperators**
At K=30%	Multipurpose N=60	Producers N=7	Consumer N=27	Marketing N=7	Pooled N=101	Pooled N=109
Poverty Headcount (H_0)	0.15	0.29	0.19	0.14	0.17	0.220
Intensity of Deprivation (A)	0.40	0.58	0.41	0.30	0.43	0.507
Poverty Index (M_0)	0.06	0.14	0.08	0.05	0.08	0.112

Source: Author's field survey data analysis result, 2017.

f. Impact of cooperative membership on multidimensional poverty

Mean difference test on the multidimensional poverty status of Cooperator and Noncooperator poultry farmers

Table 7 shows the estimate of the mean difference test, on the multidimensional poverty status of Cooperator and Noncooperator poultry farmers. The result reveals that the multidimensional poverty status (deprivations) of the Noncooperators is significantly higher than that of the Cooperators by 0.095, significant at 1% level, implying that Cooperator poultry farmers are better off than their Noncooperator Counterparts. This is in consonance with the findings of Teklehaimanot A. et al., (2016).

It is however worth noting that the obtained differences in the outcome means between the Cooperators and Noncooperators poultry farmers may not be totally linked to their cooperative membership status, owing to the menace posed by self-selection and non-compliance (Heckman and Vytlacil, 2005; Imbens and Angrist, 1994). This study thus adopts the Treatment Effect analysis which can provide a robust and consistent estimates of the impact of cooperative membership on multidimensional poverty among poultry farmers.

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Table 7: Estimates of mean difference in the multidimensional poverty status of Cooperative and Noncooperative poultry farmers

Parameter	Cooperators	Noncooperators	Pooled	Difference Test
Mean	0.411 (0.017)	0.507 (0.029)	0.468 (0.019)	0.095*** (0.037)
Std.dev	0.071	0.140	0.125	
Min	0.333	0.333	0.333	
Max	0.7777	0.555	0.7777	**P=0.0142**

Source: Field Survey data analysis, 2017. Significance level **P ≤0.05, ***P ≤0.01, Robust standard error of mean parenthesized

g. Econometric analysis on the impact of cooperative membership on the multidimensional poverty status

To estimate the impact of cooperative membership on the poverty status of poultry farmers, this study adopts the treatment effect which provides a robust but consistent estimate while correcting for self-selection and noncompliance (bias) menaces as adopted by Adenuga et al. (2016).

Results on covariates matching between the treatment and control groups

One of the important conditional assumptions to be satisfied before using the treatment effect estimators is the overlap assumption which states that, each individual has a positive probability of receiving the treatment at each level. The overlap plots which provides a visual inspection of the density distribution helps to shows the estimated density distribution of the probability of receiving a given treatment at each treatment level. There is evidence that the overlap assumption is violated when an estimated density has too much mass around the region of 0 or 1while the estimated densities will have relatively little mass in the regions in which they overlap. See Busso et al., (2011) and STATA, (2013). The overlap assumption is however satisfied when there is a chance of seeing observations in both the control and the treatment groups at each combination of covariate values. When the overlap assumption is violated, the estimates obtained becomes weak hence, reliable predictions or forecasting cannot be made with such.

Fig. 2 and Fig. 3 shows the estimated density of the predicted probabilities that a Noncooperator is a Cooperator and vice versa. From the plot, the estimated densities have most of their respective masses in regions in which they overlap also, the plot does not indicates too much probability mass around 0 or 1 hence, the overlap assumption is not violated. This is presented in fig.2 while Fig. 3 shows homogeneity of covariates between the control and treatment groups, and the plot obtained shows minimum variations in the observed characteristics, indicating a good matching quality.

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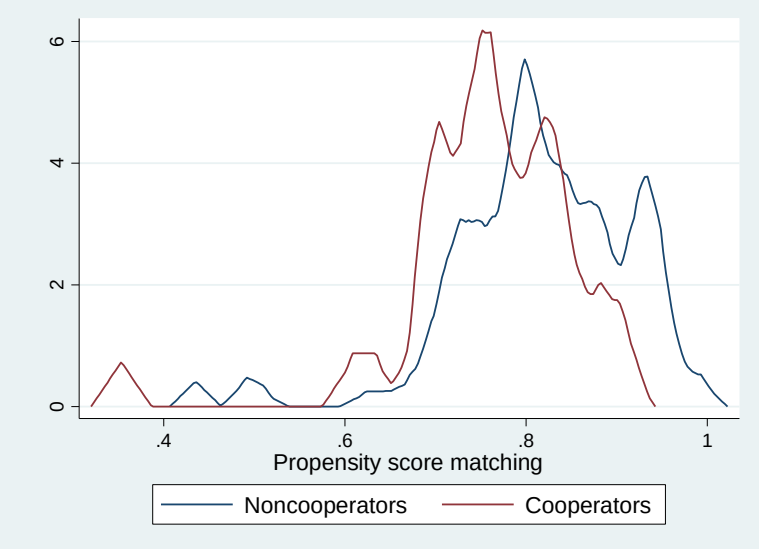

Fig 2. Propensity score distribution for overlap assumption.

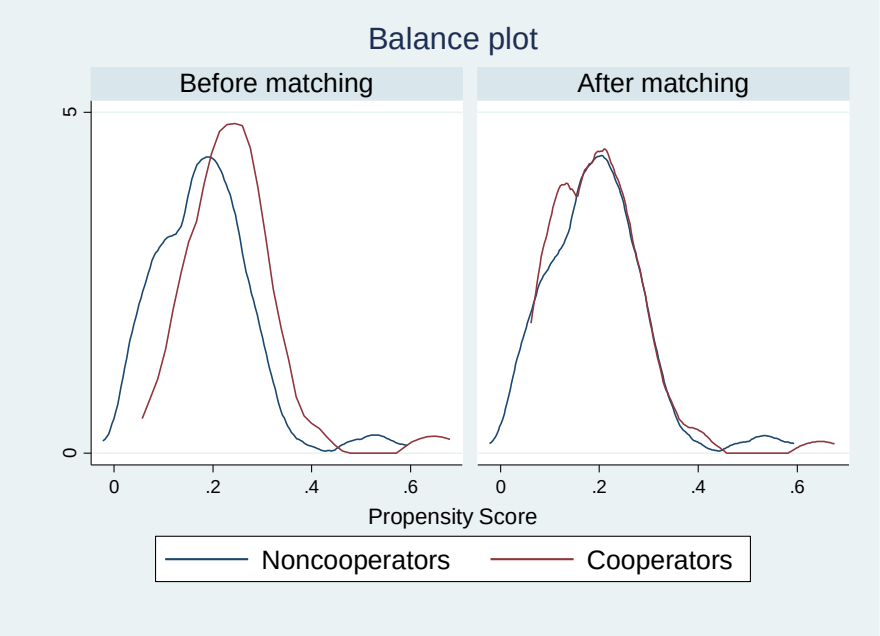

Fig 3. Before and after Propensity score matching balance plots.

The result of analysis on impact of cooperative membership on the multidimensional poverty of poultry farming households is shown in table 8. It is important to make it clear here that table 8 contains the result of analysis on the homogeneous impact of cooperative membership among the population of poultry farmers and that on the heterogeneous impacts of each cooperative societies on the multidimensional poverty status of poultry farmers in the study area, and this involves an

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algorithm of three robust treatment effect estimators which precludes; propensity score matching (PSM), inverse probability weight (IPW) and nearest neighbour matching (NNM).

The result of the Average Treatment Effect (ATE) analysis on impact of cooperative membership on poverty status of poultry farming households in the study area shows that Cooperative membership has a likelihood of reducing multidimensional poverty by -0.06, -0.03, and -0.04 as respectively obtained from the PSM, IPW, and NNM estimators, significant at 10%, 1% and 5% significance levels respectively while the result of the average treatment effect on the treated (ATET) also shows negative coefficients implying a likelihood that the poverty status of a Cooperator poultry farming household in the study area is on the average reduced by -0.09, and -0.04, as respectively obtained from the PSM, and IPW estimators and significant at 10%, and 5% significance levels respectively. This shows that cooperative membership have a significant negative impact on the poverty status of both Cooperator and Noncooperator poultry farmer in the study area. This is in consonance with the findings of Ellen Verhofstadt and Maertens (2014).

On the heterogeneous impact of the respective cooperative societies on multidimensional poverty of poultry farming households, ATE estimate shows that multipurpose cooperative have a negative impact on the multidimensional poverty with a negative coefficients of -0.03, and -0.08 respectively from the PSM, and IPW estimators. This was found to be significant at 1%, and 10% significance levels respectively while the ATET estimates also shows a negative impact of multipurpose cooperatives on the poverty status of its poultry farmer members with a negative coefficient of -0.08 obtained from the IPW estimator, significant at 5% significance level.

Regarding the producers cooperatives, the ATE estimate result show its negative impact on the multidimensional poverty of poultry farming households in the study area with a negative coefficient of -0.04 obtained from the PSM estimator, implying that producer cooperatives on the average has a likelihood of reducing multidimensional poverty among poultry farming households by -0.04 where only the PSM estimator gave a significant estimate at 1% significance level.

Furthermore, the ATET estimates show a negative impact of marketing cooperative on the multidimensional poverty status of its poultry farmer members with the obtained negative coefficients of -0.10 and -0.06 respectively from the PSM and IPW estimators. This is found to be significant at 5% and 1% level respectively.

Also, the ATET estimate result however show a significant positive relationship on impact of consumers cooperatives on the poverty status of its member poultry farming households in the study area with a positive coefficient of 0.12 from the PSM estimators significant at 5% level while the ATE estimate show no significant impact on poverty status among the heterogeneous population of poultry farming households in the study area.

Table 8: Impact of cooperative membership on the multidimensional poverty status of poultry farmers in the study area.

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Treatments	Estimates	Treatment effect estimators		
		Propensity Score Matching (PSM)	Inverse probability weight (IPW)	1 Nearest neighbour matching (NNM)
Cooperative Membership				
	ATE	-0.06***	-0.03*	-0.04**
		(0.02)	(0.02)	(0.02)
	ATET	-0.09***	-0.04**	-0.03
		(0.03)	(0.02)	(0.03)
Multipurpose Cooperatives	ATE	-0.03*	-0.08***	-0.08***
		(0.02)	(0.02)	(0.02)
	ATET	0.02	-0.08**	-0.04
		(0.03)	(0.04)	(0.04)
Producers Cooperatives	ATE	-0.04*****	-0.03	-0.05
		(0.02)	(0.02)	(0.07)
	ATET	0.04	-0.02	-0.01
		(0.06)	(0.06)	(0.05)
Marketers Cooperatives	ATE	0.01	0.03	0.02
		(0.07)	(0.09)	(0.07)
	ATET	-0.10**	-0.06*	-0.05
		(0.04)	(0.05)	(0.11)
Consumers Cooperatives	ATE	0.02	-0.06	0.02
		(0.03)	(0.05)	(0.05)
	ATET	-0.12**	-0.01	0.04
		(0.06)	(0.04)	(0.04)

Source: Author's field survey data analysis result, 2017. *** P ≤ 0.01, **P ≤ 0.05, *P ≤0.10
Robust standard errors parenthesized.

4. CONCLUSIONS AND RECOMMENDATIONS

This study aimed to evaluate the impact of cooperative membership on the multidimensional poverty status of poultry farmers in south west Nigeria. Result shows that the poultry farmers are still within their productive age from the obtained mean age of 47 years. The mean age of the Cooperator poultry farmers (49 years) was found to be significantly higher than their Noncooperator counterparts (45 years). Literacy level was found to be high as their pooled mean years of formal education is 18 years while merely 7% are deprived in basic school enrolment. However, about 26% of the poultry farming households lack access to quality healthcare. When the poverty line is set at At "k=3"; about 20% are multidimensionally poor in which the incidence and average intensities of deprivation of Noncooperators is higher (22%; 51%) than the Cooperators category (17%: 38%). The Multidimensional poverty index of the Noncooperators (0.112) is higher that the Cooperators (0.065). Also, the deprivation counts of the noncooperators is significantly higher than that of the Cooperators. Besides, result from the algorithms of the ATE and ATET analysis on the homogeneous impact shows that cooperative membership reduces

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multidimensional poverty among the Cooperator and Noncooperator poultry farming households with high levels of significance while on the heterogeneous impact, multipurpose cooperatives was found to be more effective and consumer cooperatives been least effective in poverty reduction among the 4 types of cooperative societies in the study area.

Sequel to the findings from these study, it is recommended that rural electrification and access to extension agents by poultry farmers should be improved, poultry farmers should be encouraged to join cooperatives especially the multipurpose cooperative societies to ensure poverty reduction among them. Besides, Producer cooperatives should be resuscitated in order to improve its daunting efficiency. Also, efforts should be intensified towards increased access to good electricity, clean water, quality healthcare, asset acquisition, good housing, and improved sanitation, been indicators wherein poultry farming households suffers high incidence of deprivation in the study area.

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